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Indian Standard
SPECIFICATION FOR MICA INSULATED HEATING ELEMENTS
(First Revision)

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SPECIFICATION FOR
MICA INSULATED HEATING ELEMENTS
(First Revision)

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Indian Standard
SPECIFICATION FOR MICA INSULATED HEATING ELEMENTS
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0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 19 September 1986, after the draft finalized by the Electrical Appliances Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard was published in 1972. The present revision has been undertaken to align this standard with IS : 302-1979* which is primarily based on latest IEC Publication. For the sake of convenience of reference, the format of the standard has been modified to bring it in line with IEC Publications on household electrical appliances.

0.3 Mica insulated heating elements are largely used in electric irons. This specification covers the general, performance and safety requirements for such heating elements.

0.4 This standard is to be read in conjunction with IS : 302-1979*. For the sake of convenience, the clauses of this standard correspond to those of IS : 302-1979*. Instead of reproducing full text of each clause, clauses of IS : 302-1979* which are applicable (which means that relevant provisions of the clause apply) or not applicable and the sub-clauses or portions thereof which are not applicable are indicated as under:

a) In case of a clause where it is applicable or not applicable, the wording used is 'This clause of IS : 302-1979* is applicable/not applicable'.

b) In case of sub-clause or part thereof 'Not applicable'.

Wherever a sub-clause of IS : 302-1979* is to be replaced by a new text, it has been indicated as under :

'Replacement — followed by the new text'.

Any addition to the existing provisions of a sub-clause of IS : 302-1979* has been indicated as under:

'Addition — followed by the text of the additional matter'.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

Clauses/tables which are additional to those of IS : 302-1979* are numbered starting from 101 and additional sub-clauses are numbered with the main clause number followed by **101, 102,** etc, for example **7.101.**

Additional appendices have been numbered starting from AA.

Should however any deviation exist between IS : 302-1979* and this standard, the provisions of the latter shall apply.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

This clause of IS : 302-1979* is applicable except as follows:

1.1 *Replacement* :

This standard covers the mica insulated heating elements designed to operate at voltages not exceeding 250 V ac single phase 50 Hz or dc and used in domestic heating and cooking appliances.

1.4 *Replacement* :

This standard covers the general, constructional and safety requirements and methods of tests and takes into account the influence of components on the safety and to achieve the required degree of radio and television interference suppression.

2. TERMINOLOGY

This clause of IS : 302-1979* is applicable except as follows :

2.6 to **2.8, 2.10, 2.11, 2.17** to **2.19, 2.22, 2.23, 2.25** and **2.26** Not applicable.

2.29 *Replacement* :

Conditions of Adequate Heat Discharge — The conditions of operation of the heating element under normal service conditions as specified by the manufacturer.

2.30, 2.31, 2.33, 2.34, 2.46 to **2.48** Not applicable.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

†Rules for rounding off numerical values (*revised*).

Additional Sub-clauses :

2.101 *Mica Insulated Heating Element* — An element in which heating wire, preferably ribbon, is wound on a former cut from a mica sheet. This may also be sandwiched between two pieces of mica sheets, thus insulating it from the metal body casing.

2.102 *Metal Casing* — A metallic enclosure covering sandwiched heating element and forming an integral part of the element.

2.103 *Metal Body* — The metal part of the apparatus to be heated.

2.104 *Heating Wire or Ribbon* — The current carrying part of the element having high resistance and which is the source of heat.

2.105 *Sandwiched Element* — The heating element placed in between two layers of mica sheets which insulate the heating wire or ribbon from the metal body.

3. GENERAL REQUIREMENTS

This clause of IS : 302-1979* is applicable except as follows:

3.1 Para 2 not applicable.

4. GENERAL NOTES ON TESTS

This clause of IS : 302-1979* is applicable except as follows:

4.7 to **4.10**, **4.13** to **4.17** Not applicable.

5. RATING

This clause of IS : 302-1979* is applicable except as follows:

5.1 *Replacement* :

The rated voltage shall not exceed 250 V. The preferred voltage shall be 240 V.

5.2 *Replacement* :

Rated Input — The rated input in watts shall preferably be chosen from the following values:

25	150	1 000
50	250	1 250
75	450	1 500
100	500	2 000
125	750	

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

6. CLASSIFICATION

This clause of IS : 302-1979* is applicable.

7. MARKING

This clause of IS : 302-1979* is applicable except as follows:

7.1, 7.7 and **7.8** Not applicable.

Additional Sub-clause :

7.101 The heating element may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act 1986, and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

8. PROTECTION AGAINST ELECTRIC SHOCK

This clause of IS : 302-1979* is applicable except as follows:

8.2 to **8.9** Not applicable.

9. STARTING OF MOTOR-OPERATED APPLIANCES

This clause of IS : 302-1979* is not applicable.

10. INPUT AND CURRENT

This clause of IS : 302-1979* is applicable except as follows:

10.2 and **10.3** Not applicable.

11. TEMPERATURE-RISE

This clause of IS : 302-1979* is not applicable. The test shall be applicable to the appliances where the heating element is used.

Additional Sub-clause:

11.101 *Minimum Operating Temperature* — In the assembled element, under normal operating conditions, the hottest spot temperature of mica shall not exceed 750°C.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

12. OPERATION UNDER OVERLOAD CONDITIONS OF APPLIANCES WITH HEATING ELEMENT

This clause of IS : 302-1979* is applicable except as follows:

12.2 *Replacement* :

The heating element is operated under conditions of adequate heat discharge, the supply voltage being such that the input is:

1·33 times the rated input, for heating element having a rated input not exceeding 100 W.

1·27 times the rated input or 1·21 times the rated input plus 12 W whichever is more for heating elements having a rated input exceeding 100 W.

The heating element is heated till the steady state conditions are established. If a self-resetting thermal cut-out or a non-self-resetting thermal cut-out which is accessible and can be reset without the aid of a tool operates, the operating period is considered to be ended. The heating element is then allowed to cool down and the cut-out is reset for the next cycle.

The heating element is subjected to 15 such heating cycles.

NOTE — Forced cooling may be used for the purpose of shortening the cooling period.

12.3 Not applicable.

13. ELECTRICAL INSULATION AND LEAKAGE CURRENT AT OPERATING TEMPERATURE

This clause of IS : 302-1979* is applicable.

14. RADIO AND TELEVISION INTERFERENCE SUPPRESSION

This clause of IS : 302-1979* is applicable.

15. MOISTURE RESISTANCE

This clause of IS : 302-1979* is applicable except as follows:

15.2.1, **15.2.4** and **15.3** Not applicable.

16. INSULATION RESISTANCE AND ELECTRIC STRENGTH (AFTER HUMIDITY TREATMENT)

This clause of IS : 302-1979* is applicable except as follows:

16.3 Not applicable.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

17. OVERLOAD PROTECTION

This clause of IS : 302-1979* is not applicable.

18. ENDURANCE

This clause of IS : 302-1979* is applicable except as follows:

18.1 Paras 3 and 4 Replacement.

The heating element shall be operated simulating the actual conditions of use at 1·1 times the rated input for 1 000 operating hours in cycles consisting of half an hour switching on followed by half an hour switching off.

18.2 to **18.4** Not applicable.

18.5 *Replacement*:

After the test as per **18.1**, the heating element shall withstand the tests as per **16**, the limits for insulation resistance being, however, reduced by 50 percent.

Connections and other fittings or components shall not have worked loose and there shall be no deterioration impairing safety in normal use.

19. ABNORMAL OPERATION

This clause of IS : 302-1979* is applicable except as follows:

19.1 Para 2(**b**) and (**d**), 5 and **6** Not applicable.

19.2 *Addition*:

Conditions without adequate heat discharge are obtained by testing the heating element on the floor of the test corner with the major axis approximately horizontal, in dry condition without applying any artificial means of cooling.

19.5 to **19.10** Not applicable.

20. STABILITY AND MECHANICAL HAZARDS

This clause of IS : 302-1979* is applicable except as follows:

20.1 *Replacement*:

Heating elements and their accessories shall have no sharp edges, burrs or the like which might cause injury to the user, other than those necessary for the function of the heating element.

20.2 Not applicable.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

21. TECHNICAL STRENGTH

This clause of IS : 302-1979* is applicable as follows:

21.2 to **21.4** Not applicable.

Additional Sub-clause:

21.101 The heating element shall be allowed to fall from a height of one metre on to a rigidly supported base of hardwood 50 mm thick. The element shall be subjected to five falls from such a position that its major axis is approximately horizontal, and such that each impact occurs on a different part of the heating element. It shall then be subjected to five falls from such a position that its major axis is approximately vertical, with the heating element downwards. After the test, the heating element shall show no damage within the meaning of this specification, in particular live parts previously insulated shall not have become accessible.

22. CONSTRUCTION

This clause of IS : 302-1979* is applicable except as follows:

22.4, 22.9 to **22.12, 22.15, 22.18** to **22.20, 22.22** to **22.27, 22.29** to **22.32** Not applicable.

Additional Sub-clause:

22.101 *Mica Former* — Mica former shall be made from mica sheet to the required shape which does not deteriorate during normal use for which it is designed.

22.102 *Heating Element* — It shall be made out of wire or ribbon of nickel-chromium alloy, aluminium-iron alloy or an appropriate alloy, having high electrical resistance. The resistance wire or ribbon shall conform to IS : 3725-1966†. In an assembled heating element the hottest spot wire temperature under normal operating conditions shall not exceed the temperature recommended by the manufacturer.

22.103 *Insulating Mica* — It shall be electrically insulating, thermally conducting and non-hygroscopic. The insulating mica shall be 25 micron thick.

23. INTERNAL WIRING

This clause of IS : 302-1979* is applicable except as follows:

23.1, 23.4 to **23.8** Not applicable.

24. COMPONENTS

This clause of IS : 302-1979* is applicable except as follows:

24.3 to **24.10** Not applicable.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

†Specification for resistance wires, tapes and strips for heating elements.

Additional Sub-clause:

24.101 *Mica* — Natural mica shall be of good quality and shall withstand an electrical pressure of 1 000 V ac for each 25 micron thickness. Built-up mica for heater plate shall be in accordance with IS : 2464-1963*.

25. SUPPLY CONNECTIONS AND EXTERNAL FLEXIBLE CABLES AND CORDS

This clause of IS : 302-1979† is applicable except as follows:

25.1 *Replacement*:

The heating elements shall be provided with a means of connection to supply in the form of a set of terminals or supply leads.

25.2 to **25.14** Not applicable.

26. TERMINALS FOR EXTERNAL CONDUCTORS

This clause of IS : 302-1979† is applicable except as follows:

26.1 *Replacement*:

The leads of the heating element may be of tag type or may be brought out as flexible leads of sufficient length for direct connection to any other terminals of the appliance in which the heating element is intended to be used. The junction of the heating wire and the terminal shall be securely fixed.

26.3 to **26.13** Not applicable.

27. PROVISIONS FOR EARTHING

This clause of IS : 302-1979† is not applicable.

28. SCREWS AND CONNECTIONS

This clause of IS : 302-1979† is not applicable.

29. CREEPAGE DISTANCES AND CLEARANCES

This clause of IS : 302-1979† is applicable except as follows:

29.1 *Replacement*:

Creepage distances and clearances shall not be less than the values in millimetres shown in Table 2.

NOTE — The way in which creepage distances and clearances are measured is indicated in Appendix H.

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*Specification for built-up mica for electrical purposes.

†General and safety requirements for household and similar electrical appliances (*fifth revision*).

30. RESISTANCE TO HEAT, FIRE AND TRACKING

This clause of IS : 302-1979* is applicable.

31. RESISTANCE TO RUSTING

This clause of IS : 302-1979* is applicable.

32. RADIATION HAZARDS

This clause of IS : 302-1979* is applicable.

33. FINISH

This clause of IS : 302-1979* is applicable except as follows :

33.1 The external finish used on metal components shall be of a heat and moisture resisting nature and shall not be adversely affected by variations in temperature under normal operating conditions or during endurance test.

33.2 Not applicable.

Additional Clause :

101.0 *Categories of Tests* — Tests are classified as type, acceptance and routine tests.

101.1 *Type Tests* — The tests specified in Table 101 shall constitute the type tests and shall be carried out on two samples of heating elements of the same type and rating selected preferably at random from a regular production lot. Before commencement of the tests, the heating elements shall be visually examined and inspected for obvious visual defects in respect of components, parts and their assembly, construction, mechanical hazards, markings, provision of suitable terminals for supply connections, earthing and the effectiveness of screws and connections. The external surface finish shall be even and free from finishing defects.

101.1.1 *Criteria of Acceptance* — Both samples shall successfully pass all the type tests for proving conformity with the requirements of the standard. If any of the samples fails in any of the type tests, the testing authority, at its discretion, may call for fresh samples not exceeding twice the original number and subject them again to all test(s) or to the test(s) in which failure(s) had occurred. No failure should be permitted in the repeat test(s).

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

101.2 *Acceptance Tests* — The following shall constitute the acceptance tests:

	Test	*Clause Reference*
a)	Protection against electric shock	8
b)	Input	10
c)	Temperature-rise	11
d)	Electrical insulation and leakage current at operating temperature	13
e)	Moisture resistance	15
f)	Insulation resistance and electric strength (after humidity treatment)	16

NOTE — For the purpose of acceptance tests, the humidity treatment shall be done for 24 hours while conducting the test for moisture resistance (15).

101.2.1 A recommended sampling procedure for acceptance tests is given in Appendix B of IS : 302-1979*.

TABLE 101 SCHEDULE FOR TYPE TEST

(*Clause* 101.1)

SL No.	TEST	CLAUSE REFERENCE
(1)	(2)	(3)
1.	Protection against electric shock	8
2.	Input	10
3.	Temperature-rise	11
4.	Operation under overload conditions	12
5.	Electrical insulation and leakage current at operating temperature	13
6.	Moisture resistance	15
7.	Moisture resistance and electric strength (after humidity treatment)	16
8.	Endurance	18
9.	Abnormal operation	19
10.	Mechanical strength	21
11.	Creepage distances and clearances	29
12.	Resistance to heat, fire and tracking	30
13.	Resistance to rusting	31

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

101.3 *Routine Tests* — The following shall constitute the routine tests:

Test	*Clause Reference*
a) Protection against electric shock	8
b) High voltage	13.3.2 of IS : 302-1979*

APPENDIX A

TABLES OF TYPE TESTS

This appendix of IS : 302-1979* is not applicable.

APPENDIX B

(*Clause* 101.2.1)

SAMPLING PROCEDURE FOR ACCEPTANCE TESTS

This appendix of IS : 302-1979* is applicable.

APPENDIX C

ELECTRONIC CIRCUITS

This appendix of IS : 302-1979* is applicable if electronic circuits are used.

APPENDIX D

MEASUREMENT OF TEMPERATURE WITH THERMOMETER

This appendix of IS : 302-1979* is applicable.

APPENDIX E

ALTERNATIVE TESTS FOR PROTECTED MOTOR UNITS

This appendix of IS : 302-1979* is not applicable.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

APPENDIX F

IMPACT TEST APPARATUS

This appendix of IS : 302-1979* is applicable.

APPENDIX G

THERMAL CONTROLS AND OVERLOAD RELEASES

This appendix of IS : 302-1979* is applicable.

APPENDIX H

MEASUREMENT OF CREEPAGE DISTANCES AND CLEARANCES

This appendix of IS : 302-1979* is applicable.

APPENDIX J

TEST FOR FIRE RESISTING PROPERTIES

This appendix of IS : 302-1979* is applicable.

APPENDIX K

BNF JET TEST FOR DETERMINATION OF THICKNESS OF COPPER AND NICKEL PLATING

This appendix of IS : 302-1979* is not applicable.

APPENDIX L

APPROXIMATE MEASUREMENT OF THICKNESS OF CHROMIUM ON NICKEL, STEEL AND COPPER

This appendix of IS : 302-1979* is not applicable.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

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TO
IS : 6446 - 1986 SPECIFICATION FOR MICA INSULATED HEATING ELEMENTS

(First Revision)

(*Page* 6, *clause* 7) — Insert the following after 7 and renumber the existing *clause* **7.101**:

'**7.101** The heating elements shall also be marked either on the heating element or on wrapper/carton covering the heating elements with the following information:

a) The appliances with which the heating element is intended to be used.'

(*Page* 8, *clause* **18**) — Substitute the following for the existing clause:

'**18 ENDURANCE**

This clause of IS : 302 - 1979 is applicable except as follows:

18.1 Replacement — The heating element is operated simulating the actual conditions of use at 1·15 times the rated input. It is operated under these conditions for 200 operating hours.

18.2 to **18.4** Not applicable.

18.5 *Replacement* — After the test, the heating element shall withstand the electric strength test of **16.4** of IS : 302 - 1979.'

(ETDC 43)

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(First Revision)

(*Page* 4, *clause* **2.29**) — Substitute the following for the existing clause :

' **2.29** *Replacement :*

Conditions of Adequate Heat Discharge — The conditions of operation of the heating element under normal service, that is, fitting to the heating appliances for which the element is needed.'

(ETD 32)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 AUGUST 1992
TO
IS 6446 : 1986 SPECIFICATION FOR MICA INSULATED HEATING ELEMENTS

(First Revision)

Substitute 'IS 302-1 (1979) Safety of household and similar electrical appliances : Part 1 General requirements (*fifth revision*)' *for* 'IS 302 : 1979 General and safety requirements for household and similar electrical appliances (*fifth revision*)' wherever it appears in the standard.

(ETD 32)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 DECEMBER 1999
TO
IS 6446 : 1986 SPECIFICATION FOR MICA INSULATED HEATING ELEMENTS

(First Revision)

(*Page* 11, *clause* **101.1**, *first sentence*) — Substitute the following for the existing:

'The tests specified in Table 101 shall constitute the type tests and shall be carried out on one sample of heating element selected preferably at random from a regular production lot.'

(*Page* 11, *clause* **101.1.1**, *first sentence*) — Substitute the words 'The sample' *for* 'Both samples.'

(ETD 32)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 5 MAY 2002
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(First Revision)

(*Page* 5, *clause* **5.2** *Rated Input*) — Insert '600' at the appropriate place.

(ETD 32)

Reprography Unit, BIS, New Delhi, India